THE NATURE CONSERVANCY NEWS

September/October 1979

BIRDS

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THE NATURE CONSERVANCY NEWS

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COVER: Winter sun and ducks, San Francisco Bay. Photo by Ruth Toriello. **Inside front cover:** Saw-whet owl by R. Hamilton Smith/Earth Imagery. For other credits, see page 25.

The Nature Conservancy is a national conservation organization committed to the preservation of natural diversity by protecting lands containing the best examples of all components of our natural world.

To date the Conservancy and its members have been responsible for the preservation of 1,538,970 acres of forests, marshes, prairies, mountains, and islands: home to rare and endangered species of wildlife and plants. 2,211 projects have been completed since the acquisition of the first preserve in 1954. Approximately 60% of all preserves are retained by the Conservancy and managed by volunteer land stewards.

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Baffles, Hacking, and Foster Birds

Strategies for Saving our Dwindling Birdlife

by David R. Zimmerman

• On a tiny, wind-torn isle just offshore from Bermuda, a bearded, surf-soaked biologist, David Wingate, clambers ashore and ties his motorboat to a coral head. He then carefully fits a wooden board over the front of a jagged cave that has been carved out of the rock by the incessant pounding of the waves. In the board is a precisely cut elliptical hole, 127 mm wide by 54 mm high. This opening is barely large enough to admit the Bermuda petrel, or cahow, which breeds in the burrow. The hole also is just *small* enough to keep out the marginally larger white-tailed tropicbird—a species that would take over the niche and destroy the petrel egg or chick.

Using the cave-front baffle, and other protective techniques, Wingate, over two decades, has slowly saved the once common petrel from almost certain extinction. The bird exists only on the several islets that have been its last refuge from the environmental degradation of Bermuda's main islands. The species' total population now may exceed 100 birds.

• Hiking through the heart of a vast highland marsh in southern Idaho, biologist Roderick Drewien barely pauses as he passes abreast of a crude, slightly raised platform nest made of last year's dry, brown marsh reeds. He stoops slightly. With one hand he picks up a huge, lovely brown-spotted egg, still warm from the body of the mother bird, a sandhill crane, whom he has flushed from her nest. With his other hand, Drewien gently places in the nest a slightly larger, lighter-colored egg that he has brought with him. It is a whooping crane egg, flown in that morning from a Canadian marsh, a thousand miles to the north, where the surviving small band of wild whoopers continues to breed. Having deposited the egg in the nest, Drewien quickly leaves the marsh.

The mother sandhill crane soon returns, and settles down on the alien egg. She broods it as if it were her own. The egg hatches several days later, adding one more whooper to the small group being raised by the sandhills. Using sandhill cranes as foster parents provides insurance against natural and human-caused disasters that might strike the existing wild whooper band in Canada.

• Not far from Baltimore, atop a metal tower on an uninhabited Chesapeake Bay island, four fledgling peregrine falcons lounge lazily in the hot July sun. An unwary killdeer flies across a nearby meadow. One young peregrine suddenly launches itself from the tower, flaps up overhead, then chases falteringly downward toward the killdeer, which easily escapes. The peregrine circles back to the tower. Later the fledgling will tear at a prepared meal of chicken and quail, laid out by

As a graduate student, Paul Spitzer of Connecticut devised the method of egg transfer and used it to help bolster the dying osprey population in Long Island Sound.

falconer-biologists who watch over it 'round-the-clock from a nearby blind.

A few days later, the falcons are taking their own wild prey—one sampling a pigeon, another an immature green heron. One of the peregrines does not survive, but the three others soon are free-flying, wholly independent wild birds. All four falcons were hatched in an incubator at Cornell University. They are part of a three-decade, multi-million-dollar effort to reintroduce alien, but comparable strains of wild peregrines into the eastern U.S. to replace the native population that was wholly wiped out by DDT.

The preceding scenes illustrate how scientifically-oriented conservationists now are striving to save endangered birds, and the methods they are using. The conservationists have developed imaginative ways to preserve the lives and enhance the reproductive success of individual wild birds, thereby halting the decline of very rare species and rebuilding their populations. The aim is to find and treat the most immediate threats to a bird's survival, and bolster its population to the point where standard conservation practices (habitat preservation, legal protection, public education), combined with Nature's ability to heal itself, can insure the species' recovery from possible annihilation.

The peregrine falcon experiment is actually more extreme—and therefore more controversial. Rescue efforts came too late for the peregrine subspecies that formerly bred in the eastern U.S., *Falco peregrinus anatum*; restitution thus must be made with peregrines of other races. Some environmentalists object to this introduction of alien stock. But the project's leader, Cornell zoologist Tom Cade, points out that without the reintroductions, a species that once was an integral, and dramatic, part of eastern North America's avifauna will be absent forever.

The peregrines being introduced, which for the most part are native to the Pacific Northwest, look and act like the missing Eastern *anatum* birds, Cade says. Only an expert, birds in hand, could tell them apart. In his view, an introduced line of falcons that can sustain itself in the wild is far preferable to no peregrines at all.

The speed with which the Eastern peregrine falcon vanished—it was gone a dozen years after its decline first was noticed—has been a principal spur to the development of the new emergency methods that can be employed to pull a bird back from the brink. One of these methods, egg transfer, was invented by Cade's graduate student, Paul Spitzer, to bolster the dying osprey population along the coast of southern New England.

Young Spitzer, a neighbor and protégé of bird artist Roger Tory Peterson, speculated that DDT was acting on the osprey population by rendering the eggs infertile, but was doing no serious harm to the surviving adults. Consequently, the colony might be kept going—until DDT was banned and its residue in the food chain had declined—if "clean" osprey eggs could be brought to New England from other areas where DDT contamination was less of a problem.

To test this view, Spitzer obtained eggs from Chesapeake Bay ospreys, which were not only accepted but also hatched under the New England ospreys. The transplanted ospreys migrated south in winter; and—the crucial factor—when the time came for them to breed, they returned to New England where they hatched, and not to Maryland where they originated.

To move the osprey eggs, Spitzer places them in an insulated suitcase kept warm by a hot water bottle, hand-carries them, and holds them on his lap to cushion them against plane and auto engine vibrations. This method has since been used to move whooping crane eggs, as well as the eggs for a number of other endangered birds. The whooping crane experiment in Idaho carries matters a step further. It uses cross-fostering—putting one species' eggs in another's nest. Birds of prey are

remarkably accepting of others' eggs, even when the eggs are a slightly different size and color than their own, and yield chicks that appear quite different. Hawks and kites, for example, will hatch and raise eaglets that quickly grow to dwarf them!

These promising facts first were established by a young West Berlin raptor expert, Bernd-Ulrich Meyburg, who has worked in Czechoslovakia to save the locally endangered lesser spotted eagle. He found that black kites (hawk-like raptors) willingly would foster eagle eggs and chicks. This provided a conservation advantage, Meyburg reported, because lesser spotted eagles, like whooping cranes, usually lay and hatch two eggs, yet rarely fledge more than one of the young.

Sibling rivalry between the two chicks, in eagle families and perhaps also in cranes, very often leads to the demise of one chick. With eagles, this behavioral trait is called "the Curse of Cain." The phenomenon may have survival value over the long run under natural conditions; but in the face of rapid, widespread human destruction of eagles and their habitat, the normally-doomed second egg becomes a valuable conservation resource when it is cross-fostered to another raptor.

The ability to hatch, rear, and fledge two eggs from a pair of wild birds, which ordinarily would produce only one offspring, of course *doubles* the pair's annual productivity. Using different strategems, even more eggs and young can be produced. In ospreys, peregrines, and many other birds of prey, removing the first clutch of eggs after all have been laid prompts the adult pair to renest, mate again, and produce a second clutch. Meanwhile, the first clutch eggs are transferred or cross-fostered to other wild birds, or hatched indoors in an incubator.

Even more dramatic results have been attained in captive breeding programs. For instance, whooping cranes that normally would produce two eggs in the wild have been induced to produce two dozen in a season by using artificial insemination and removing each egg as soon as it is laid. The hope is that this resource can be reinvested in the wild population, either by cross-fostering the crane eggs—as Rod Drewien is doing in Idaho—or by returning young birds directly to an endangered wild population, as experts at the federal government's endangered species breeding program at Patuxent, Maryland, soon hope to do.

Capturing endangered birds for breeding programs is one of the most controversial facets of the new conservation methods. It makes more sense to assist wild birds within their natural habitat, since fewer variables are involved. In addition, captive lines become inbred, lose their reproductive vigor, and select for traits that favor survival in cages rather than survival in nature. Biolo-

Inventor of the cross-fostering technique, Bernd-Ulrich Meyburg worked in Czechoslovakia to help save the lesser spotted eagle.

gists fear that after two or three generations in captivity, the captive stock may no longer be suitable for wild living. But sometimes, as with the peregrine falcon, there is no alternative.

Trapping wild birds is often fairly simple. Inducing them to breed may not be. Tom Cade and other biologists at Cornell University for the most part are falconers, who have much experience in handling birds of prey, and a thousand-year-old oral and written tradition to guide their work. Traditional falconers, it must be added, rarely tried to breed their birds, since they favored wild-caught raptors for their sport. Nonetheless, the Cornell group needed only five years' effort to develop reasonably consistent breeding techniques for peregrines.

There is much less handling and captive-breeding information available on cranes than on falcons. This is one reason why scientists at the Patuxent Wildlife Research Center required longer —more than a decade—to achieve consistent production of fertile whooping crane eggs. This occurred only within the last several years.

The most difficult step may be returning captive-produced eggs or young birds to the wild. Here, too, the falconer-biologists working with peregrines have an advantage. The experiment at the island tower near Baltimore, which now is being repeated each summer at several other secure locations in the Northeast, is based on a falconry technique called hacking. When a falconer captures a young, wild peregrine, he cuts, or hacks up meat, and feeds it to the falcon out-of-doors at a hack board. The peregrine is allowed to remain free—to fly, and to develop its chest and wing muscles. It will return to the hack board when hungry, until it can hunt and kill prey for itself. At that moment the falconer must catch and tether the bird, or else lose it back to the wild.

In releasing captive-bred peregrines, the Cornell falconer-biologists reverse the true falconer's method. The young falcons on the tower are fed at hack until they begin to fend for themselves—at which time the food handouts are withdrawn—and the peregrines are encouraged to sustain themselves in the wild.

Tom Cade and his wife, Renetta, along with ornithologist Mitchel Byrd from William and Mary College, and a student of Dr. Byrd, Doug Davis, released five Cornell-bred peregrines in July, 1978, at a hacking site on The Nature Conservancy's Virginia Coast Reserve (VCR). This past summer Doug Davis released five more young peregrines at VCR, using a specially constructed tower as a hacking site, which has a platform on top. Equipped with a nesting compartment, the platform was home and dinner table for the fledglings. About eight weeks after first flying the falcons were hunting on their own. One of the raptors released in 1978—a male named Striker—returned last spring and stayed around long enough to become acquainted with one of the young females released this summer.

A Florida sandhill crane feeds mealworms to a whooping crane chick as part of the federal government's endangered species breeding program at Patuxent, Maryland.

The crane biologists, with no comparable release technique to fall back on, have been far less successful in returning captive-bred whoopers to their natural habitat. A number of whooping crane eggs from Patuxent have been cross-fostered to Drewien's wild sandhill cranes in Idaho, but so far all have failed to thrive and survive—for a puzzling variety of reasons. No technique has been perfected to return hatchling or older cranes to wild populations.

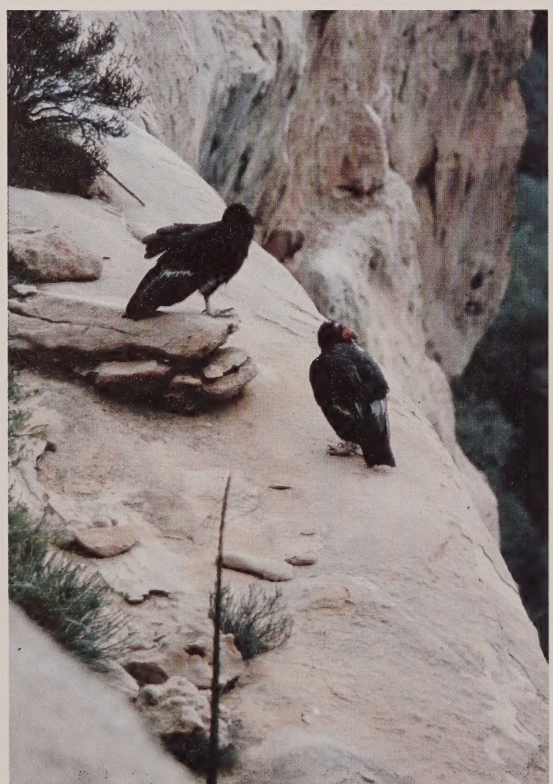
Therefore, captive breeding strikes many endangered species biologists as a last resort—to be used only when there is no other means in sight to save a dying species from extinction. At this moment, the most controversial case in point is the California condor.

The major steps that have been taken to save this magnificent vulturine bird have not stemmed its decline. The condor is legally protected from shooting and harassment throughout its range, and

a large breeding sanctuary has been established for it in the Sespe Creek area, north of Los Angeles, California. But the birds are breeding poorly. Whether this is due to DDT, other toxic chemical residues, or some other effect of human encroachment simply is not known.

The first highly manipulative attempt made on the condors' behalf was opening "Condor Restaurants"—feeding stations—near Sespe Sanctuary. The reasoning behind this idea was that as cattle ranches have given way to suburban sprawl in the surrounding areas, the condors no longer can find enough dead meat to eat. So road-killed deer and freshly-killed livestock carcasses were put out for the birds during the winter breeding season.

The condors used the food source. But its effect, if any, on the birds' faltering productivity has been slight. Meanwhile, the population has fallen from 50 to 60 birds of a decade ago, to perhaps 20 or 30 today. This drastic decline prompted a prestigious Condor Advisory Panel, appointed by the American Ornithologists' Union and the National Audubon Society, to propose severe new measures: "A large proportion of the present population should be trapped and bred in captivity. First-generation offspring should be retained for breeding, and propagation should be continued long enough to produce at least 100 second-generation or third-generation offspring for release to the wild."



The California condor continues to decline despite major efforts to save it.

Instead of returning these birds to the humanly-impacted Sespe Sanctuary, they would be established at more remote and protected sites within their former range, or even outside it, using techniques like hacking.

This proposal—which will be vigorously debated in the months ahead, since it requires Congressional approval—is a long-range gamble. Condors do not breed before they are *at least* five years old, and a pair then produces only one egg every two years. Manipulative methods might double or even quadruple this yield; but even if the methods work, recovery will take decades.

The many problems inherent in this plan have provoked opposition by some biologists, most notably Carl Koford of the University of California, who conducted the first detailed study of the condor for the National Audubon Society, four decades ago. He insists, correctly, that much important data still is lacking on the status of the wild population, and complains that the "dramatic artificial methods" of captive propagation and release "seem too expensive and controversial for efficient action." He asks, "Do we want to replace wild condors with cage-bred, hand-raised birds?"

No one wants to. The question is whether there is any possibility of success with Koford's counter-proposal, which essentially is to clean up and preserve the habitat near Los Angeles to make it safe for condors. The members of the Advisory Panel appear to doubt that this could be accomplished quickly enough to save the almost extinct condors.

The new manipulative techniques to save disappearing birds are all labor-intensive, costly, and risky. They are last, desperate measures—emergency room care for dying species. Furthermore, as in clinical medicine for humans, these methods are *not* the ideal way to treat and protect live beings. But they will serve their purpose well if they save some populations that already are far along on the road to extinction, and—more important—if they remind us that for birds, as for people, *prevention* is the better strategy for health.

When ample habitat has been set aside, and an effective monitoring network is established to detect subtle, ubiquitous environmental threats, then emergency measures no longer will be needed to sustain our birds and other wild animals.

An independent professional writer, **David R. Zimmerman** reports frequently on science and the environment. He has been the medical columnist in the *Ladies Home Journal* for more than a decade. His book on aiding endangered birds is entitled *To Save A Bird in Peril* (Coward, McCann & Geoghegan, Inc., 1975.)

Hawaii's Birds, 1979

by Andrew J. Berger

Over half of all the U.S. birds listed by the Fish and Wildlife Service as threatened or endangered species are Hawaiian birds. In addition, more kinds of bird species already have become extinct in Hawaii than in any other part of the world, except for the Mascarene Islands in the Indian Ocean. Since Captain James Cook did not discover the Sandwich Islands (Hawaii) until 1778, how did this irretrievable loss of bird life occur in a period of only 200 years?

Actually, little or no proof exists for the causes of extinction for most of the birds. We do know that rabbits introduced to Laysan Island about 1903 virtually destroyed all of the vegetation on the island before 1923, thereby causing the extinction of the flightless Laysan rail (*Porzanula palmeri*), Laysan millerbird (*Acrocephalus f. familiaris*), and the Laysan apapane (*Himatione sanguinea freethii*). However, for the main inhabited islands in the chain, no single factor can be pinpointed precisely.

The extensive destruction of the endemic Hawaiian rain forests between 1800 and 1930 greatly reduced the essential habitat for the forest birds, but we have no conclusive evidence that it caused the extinction of any bird species. The native forests were destroyed by introduced herbivores such as goats, sheep, cattle, horses, and English pigs. H. L. Lyon said that on Oahu in 1919, "cattle have been the greatest factor in pushing the forests back to their present narrow limits, and at certain vital points cattle are still allowed to penetrate the remaining forests." C. S. Judd, the Superintendent of Forestry for the Territory of Hawaii, in 1927 spoke of the years from 1815 to 1921 as the "cattle period in Hawaiian forestry." L. W. Bryan, another forester, reported that more than 10,000 introduced herbivores were killed *every year* from 1921 to 1946 in "forest reserves" on the island of Hawaii alone. Feral goats and sheep caused irreparable damage on some of the islands, and the axis deer added to the destruction on Molokai. Most of the feral cattle have now been eliminated, but goats, sheep, and axis deer are still destroying forests, or preventing their recovery.

Amakihi

In 1957, Hawaii's Territorial Division of Forestry initiated a cooperative agreement with the U.S. Forest Service to conduct a forest survey and the necessary research aimed at developing a timber industry in Hawaii. Since that time, the Institute of Pacific Islands Forestry, Pacific Southwest Forest and Range Experiment Station, in Honolulu, has given guidance to state foresters. Until recently, the board-feet-oriented federal foresters referred to the endemic Hawaiian ecosystems as "decadent forests," consisting of "weed species" and "unproductive forest land." Consequently, state forestry plans have continued to place emphasis on planting exotic tree species.

Hawaii now boasts more than 4,600 species of exotic flowering plants. The vast majority of the islands' native forest birds simply do not adjust to exotic vegetation. What is worse, during the past 20 years, more than 40,000 acres of near-virgin native forests have been bulldozed in order to plant exotic tree species, many of which do not even have a potential commercial value.

Another serious factor on Molokai (and on Hawaii) is the "absentee-landlord" malaise—large ranches that are owned by mainland people who have no concern for the unique Hawaiian biological heritage. It is because of such ranches—where hunting by local people is prohibited—that the axis deer population far exceeds the "carrying capacity" of the range. Consequently, the deer move into the remnant forest and hasten its destruction.

The remarkable feather capes and headdresses of the Hawaiian chieftains have been widely publicized since 1778. It took great skill for the Hawaiian bird-catchers to snare forest birds with bird lime, which they obtained from the juices of certain plants, so it seems unlikely that this custom resulted in the extinction of any species on the larger islands, especially since the forest covered vast expanses of the volcanic slopes. When collectors began using shotguns near the end of the last century, however, the days of the most prized plumage birds became numbered.

It is quite possible that indiscriminate collecting caused the extinction of the black mamo (*Drepanis funerea*) on Molokai. This remarkable black honeycreeper with a stout, long, and sharply decurved bill was discovered by the English biologist R. C. L. Perkins in 1893, who then thought it a rare bird. The last known birds were collected in 1907, and there appear to be no later records of the species.

More than 170 foreign bird species have been introduced to Hawaii. Of these, some 50 species (such as the mockingbird, western meadowlark, cardinal, house finch, California quail, Japanese white-eye, and common Indian myna) have become established. However, we have no evidence that they compete adversely with any of the forest birds because no thorough studies have been conducted. We do know that the exotic species brought a number of bird parasites to Hawaii, and it is often stated that introduced diseases caused the extinction of the Hawaiian forest birds. Bird malaria usually is cited as the principal villain, although, to date, this blood disease has been found in less than a dozen endemic birds. Therefore, although disease appears to be a most logical cause for extinction, we have no reliable evidence that it was. Moreover, there still remains the problem of explaining why certain species—such as the apapane, amakihi, iiwi, and the anianiau—are abund-

ant in suitable habitats, whereas other species that occupy the same habitat—like the ou, Kauai nukupuu, and Kauai akialoa—are either extinct or are now rare. Obviously, bird diseases are not likely to be species specific.

The U.S. Navy and Marine Corps have preserved habitats for Hawaii's endangered waterbirds by setting aside protected areas that provide cover and nesting habitat. It has been through the leadership of The Nature Conservancy, however, that two extensive forest areas have been saved for their flora and fauna. Some 4,625 acres of the 9,000-acre Kipahula Valley on Maui have been preserved and added to Haleakala National Park. I had the pleasure of participating in the 1967 expedition into the near-virgin valley, during which a once-thought-to-be-extinct bird species, the Maui nukupuu (*Heminagthus lucidus*) was rediscovered. Also, in 1978, the Conservancy acquired 3,300 acres of the Maulua Nui forest on the slopes of Mauna Kea, Hawaii. The wilderness supports such threatened and rare birds as the ou, akepa, Hawaiian creeper, akiapolaau, and the io.

There is a simple reason for the uniqueness of Hawaii's endemic birds. The Hawaiian Islands are more isolated from the continents than any other islands—they are more than 2,500 miles from either North America or Asia. As a result, only a few landbirds found their way to the islands over the hundreds of thousands of years since the time these volcanic islands emerged above the ocean surface. Judging from studies on the ages of the islands in the chain, a successful colonization of a bird species was necessary only once every 300,000 years to produce the species that exist today. Therefore, only about 15 founding species were necessary to evolve to produce some 70 unique Hawaiian bird species that occur nowhere else in the world. These include a hawk, an owl, a crow, two thrushes, an old-world warbler, an old-world flycatcher, and the entire family of Hawaiian honeycreepers. The honeycreepers demonstrate adaptive radiation to a more striking degree than any other of the world's approximate 170 bird families, including the Galapagos finches, which were so important in crystallizing Charles Darwin's thinking about evolution. Adaptive radiation is a type of evolutionary change in which members of a single species or of a closely related group of species develop very different physical traits to adapt to all the different niches in the islands. For example, one honeycreeper has a long downcurving bill to suck nectar from one particular flower, while another honeycreeper has a parrot-like bill for crushing seeds.

Unfortunately, few endemic forest birds survive in Oahu, Molokai, or Lanai Islands, and most of those that do are very rare, presumably on the verge of extinction. This means that only on Kauai, Maui, and Hawaii can one find the Hawaiian forest birds in numbers, and the habitat where the birds live constitutes an extremely small part of each island. In a very real sense, every bit of this remnant habitat is "critical habitat" for the Hawaiian forest birds.

Kauai is notable because it is the only one of the main islands having all of the birds known to have occurred there during historic times. The island is notable, as well, because the introduced mongoose was not liberated there. It probably is because of this that the koloa or Hawaiian duck (*Anas wyvilliana*) survived on Kauai, while becoming extinct on all of the other islands during this century. However, several reports of the mongoose on Kauai have been made since 1976.

Despite the destruction of lowland and mid-elevation vegetation by sugar planters, ranchers, and feral grazing animals, a wilderness area man-

Crested honeycreeper

Kauai oo

aged to survive on Kauai because of the rugged terrain. This primeval area is the Alakai Swamp. "Swamp" is a gross misnomer—the region consists primarily of a series of sharp mountain ridges and intervening valleys, with some bogs on plateaus at higher elevations. It is an area of very high rainfall. More than 600 inches (50 feet!) of rain have been recorded in a single year on Mt. Waialeale at one edge of the area. The 10,000 acres of the so-called state Alakai Wilderness Preserve have been saved only because they were not suitable for agriculture, ranching, or development. Its fate, however, is still in jeopardy because of the continuing encroachment of exotic vegetation. There also remains the danger of again reviving plans to build a Kokee dam. The dam would destroy hundreds of acres of this prime habitat, even though a 1957 Irrigation Authority report to then-Governor Samuel Wilder King stated, "it would not be practicable to incorporate either flood-control or hydroelectric power development in the plans for the proposed Kokee irrigation project." Robert Wenkam has discussed these and other problems of the Alakai Swamp in his book, *Kauai and the Park Country of Hawaii*.

The Kauai oo (*Moho braccatus*) is the sole surviving species of a group of five honeyeaters (family Meliphagidae) once found in the Hawaiian Islands. John L. Sincock of the U.S. Fish and Wildlife Service found the first nest of this species in 1971, but he believes that the surviving population does not exceed a dozen birds.

It is the endemic honeycreepers, however, that have been decimated. During the last century, there were 23 species and 24 subspecies. Of these honeycreepers, 7 species and 4 subspecies now are extinct and 22 other species and subspecies are classified as threatened or endangered. In addition, the iiwi is extinct on Lanai and so is the crested honeycreeper on Molokai.

The Kauai akialoa unfortunately may now be extinct. Two birds were seen in the 1960s; but John Sincock has not seen the species, although since 1968 he has spent more than 400 days in the Alakai Swamp.

The Kauai nukupuu has been reported only a half dozen times since 1960. Despite the unique bill of the nukupuu, however, it is not an easy bird to identify under typical field conditions, unless it is close at hand. Sincock thinks that this honeycreeper is more common than the few sight records suggest and that a population as large as 100 may still inhabit the rain forest. Another honeycreeper, the ou, once inhabited each of the main islands.

Nene (Hawaiian goose)

Now it is extinct on three islands—Oahu, Molokai, and Lanai—is rare on Hawaii, and has not been reported on Maui during this century. Only on Kauai is the ou apparently holding its own, and Sincock believes the present population to number in the low hundreds.

Maui has a relatively undisturbed wilderness area on the northeast slope of Haleakala Crater. Like the Alakai Swamp on Kauai, this slope on Maui has proven unsuitable for agriculture, ranching, or urban development. Most of the critical habitat is now encompassed by a state forest reserve and by Haleakala National Park. The endemic birds occur in native forest extending from approximately 3,500 feet to tree line at 6,800 feet. It is a region with steep to precipitous slopes and a high annual rainfall. Night-time temperatures during many months of the year fall to 45° F. or below. No systematic studies were conducted until the summer of 1973, when a group of undergraduate students studied the Hana rain forest on a National Science Foundation student-organized ecology project. The summer was unusual in that the rainfall was the lowest since recordings were initiated. A new genus (*Melamprosops*) of bird was discovered by the students. The bird later was assigned to the honeycreeper family, thus making a total of 10 species of this family known to have inhabited the rain forests of Maui. Virtually nothing is known about the breeding dynamics of any of the species.

The island of Hawaii, the "Big Island," is larger (4,030 square miles) than all of the other islands combined. Nearly half of all the landbirds found there during the last century are extinct and half of the surviving species are threatened with extinction.

Only by flying over Hawaii at low elevations in a helicopter or small airplane can one fully appreciate how little suitable habitat still remains for the forest birds. Vast areas on the slopes of Mauna Loa (13,677 feet) consist of barren lava. In the lower reaches (below 6,000 feet), where rainfall is ample, one finds extensive areas devoted to cattle pasture, often of a marginal character—perhaps a "good" tax write-off for local or absentee landlords. Such ranches also extend downward through the best native habitat to 4,000 feet or lower. Some forests in these prime locations also are being ruined by the harvest of koa (*Acacia koa*) trees. The struggling timber industry advertises koa for its beauty as bar tops, counters, and conference tables. The endangered species that inhabit the ohia-koa-treefern forests are the Hawaiian hawk, Hawaiian crow, ou, creeper, akepa, and akiapolaau.

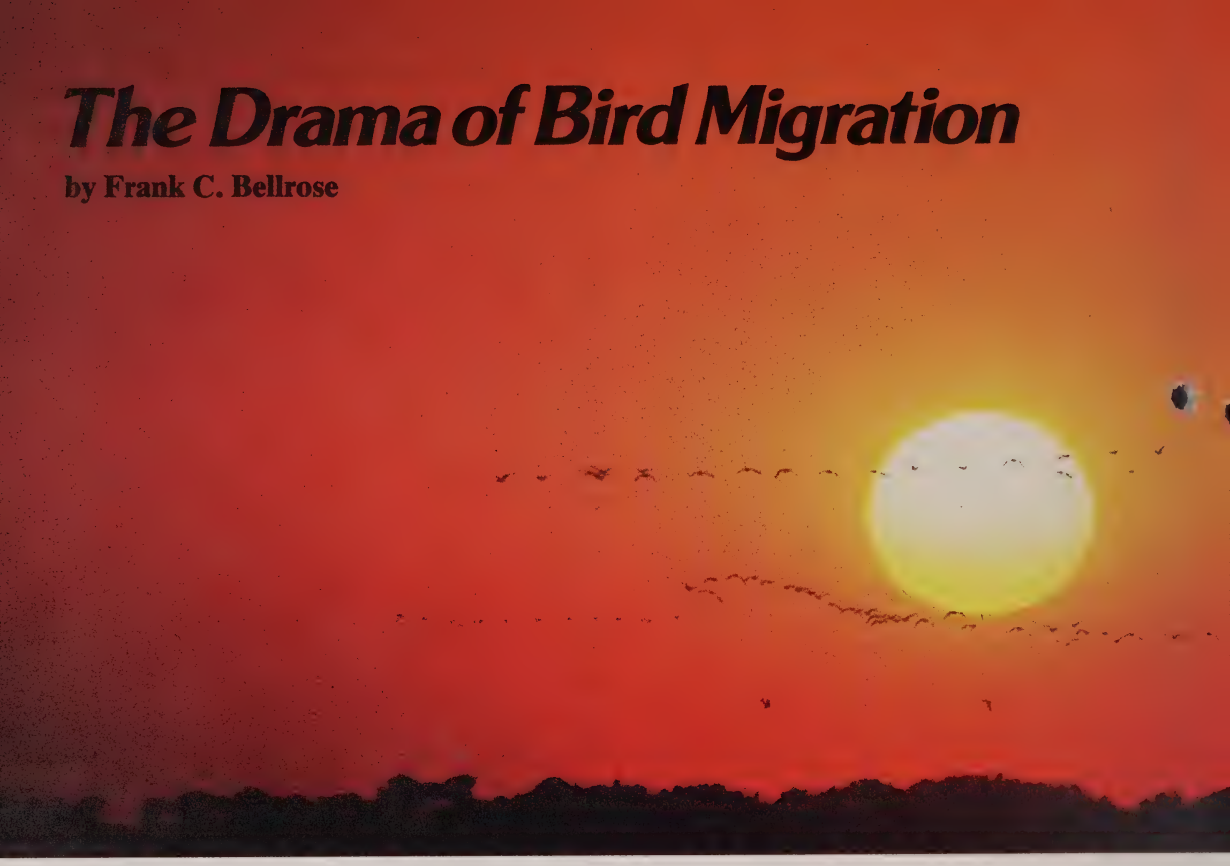
Hawaiian hawk

So desperate is the Hawaiian situation that the U.S. Department of Interior appointed eight Recovery Teams for Hawaii alone, four of them for rain forest birds. Each of these teams has developed plans to rescue the birds based on the biological requirements of each species. Only by implementing these plans can there be any hope of saving Hawaii's birds. Until then, the future of our 50th state's unique landbirds remains doubtful.

Andrew J. Berger is a Professor and past-chairman of the Department of Zoology at the University of Hawaii. Among his numerous scientific affiliations and activities, Dr. Berger is a member of the Hawaii Forest Birds Recovery Team and Leader of the Palila Recovery Team. His most well known book is *Hawaiian Birdlife* (University of Hawaii Press, 1972).

The Drama of Bird Migration

by Frank C. Bellrose



A chorus of calls emanating from the night sky told us that swarms of migrant birds were passing overhead. A few minutes later the radarscope confirmed what we were hearing. With each sweep of the antenna, the surface of the scope lighted with dozens of bird targets moving north. Earlier, shortly before sunset, the scope had been empty of all but ground targets.

Oddly, most birds that are otherwise diurnal (active during the day) migrate almost exclusively at night. This is particularly true of passerines, or songbirds—the species that we often notice when they arrive in yards, woods, and fields in the spring. We know they arrived during the night, but where did they come from? Where are they bound? How will they get there?

Since the days of Aristotle and Pliny, people have wondered about the mysterious appearance and disappearance of birds. The ancient philosophers speculated that birds fly south for the cold months, but they also believed that large numbers of birds hibernate. (Amazingly, in the southwest desert, the poorwill actually does hibernate—the only bird known to do so.) With all the speculations, little progress was made in understanding bird migration until the 19th century. Still, as much mystery as fact prevailed until recent times. With new tools that became commonplace following World War II, such as radar and radio telemetry, scientists retackled the challenge of migration. Their probings have given tremendous insight into many aspects of bird migration, particularly navigation, but much mystery still shrouds the phenomenon itself.

Distant Flights

In migrating between their summer and winter homes, many bird species navigate with great accuracy, making fantastic journeys. As a group, shorebirds make the most remarkable migratory flights. The white-rumped sandpiper, no bigger than a sparrow, breeds in the coastal tundra of Arctic Canada and winters through Argentina to land's end at Cape Horn.

The more familiar golden plover is unusual in following different routes in spring and fall, which together form an elliptical pattern. The plovers journey from the Argentine pampas through mid-America to tundra breeding grounds in Canada and Alaska. Upon leaving the tundra breeding grounds, most golden plovers migrate southeastward to Nova Scotia and New England and then out across the Atlantic Ocean to northern South America—an over-the-ocean flight of at least 2,000 miles.

A plover relative with the unlikely name of bristle-thighed curlew nests in only one small area

of Alaska, near the mouth of the Yukon; yet it winters on many South Pacific islands from Fiji to the Tuamotu Archipelago. This represents a one-way flight of about 5,000 miles entirely over the Pacific Ocean, although some birds may stop en route at islands further north, such as the Hawaiian Islands. The fact that a small population of bristle-thighed curlews has survived over a long period attests to the species' navigational capability over water.

Waterfowl also make dramatic migrations, though none are as spectacular as the journeys of shorebirds. Pintails breeding in Alaska may winter in the Hawaiian Islands—one banded in Utah was recovered on Palmyra Island, over 1,000 miles south of Honolulu, Hawaii. Other Alaskan pintails migrate through California as far south as Costa Rica, Central America. A blue-winged teal banded at Oak Lake, Manitoba, was recovered over 4,000 miles away at Lima, Peru; while an immature blue-winged, banded at the Athabasca Delta, northeastern Alberta, reached Maracaibo, Venezuela, in a month—a minimum flight of 3,800 miles.

Lesser snow geese, breeding on Baffin and Southampton Islands in northern Canada, winter in coastal Louisiana and Texas. An eastern contingent flies nonstop from James Bay to Louisiana, a distance of 1,800 miles. But the Pacific black brants outshine even this feat. They migrate from the Izembek Lagoon, near the tip of the Alaskan Peninsula, southeastward over the Pacific Ocean to Baja California, Mexico. And they don't loaf along the way: one flight arrived at San Quintin Bay, Baja California, just 45 to 60 hours after leaving Izembek Lagoon—a distance of nearly 3,000 miles. Assuming a nonstop flight, they flew the distance at a minimum speed of about 50 miles per hour (figuring the maximum time aloft) or perhaps as much as 66 miles per hour (figuring the minimum time aloft). Radar at Izembek indicated departure flight speeds of 69-75 miles per hour.

Behavior Aloft

Recent observations by radar and by lighted paths projected from an airplane have told us much about how migrating birds are distributed in the air space.

Most birds depart in migration shortly after sunset, climb quickly to altitude, fly for several hours, and begin a gradual descent after midnight, with a final descent from low heights at the approach of dawn. Most songbirds are out of the air by daylight, but ducks and geese may fly on to appropriate resting areas. Geese in particular may continue to fly long distances by day.

Birds have various ways of gaining altitude

Migrating snow geese in "V" formation. Thousands of snow geese winter at the Conservancy's Virginia Coast Reserve each year. Opposite page: a flock of mallards takes off.

after "take-off." Ducks and geese climb steadily but rather slowly, while flocks of pelicans and cranes have been observed to spiral upwards for many hundreds of feet prior to leveling off in migratory flight. I have observed flocks of migrating sandpipers using both these means of gaining altitude. An apartment dweller in Toronto, Ontario, watched white-throated sparrows move from the ground to the tops of tall trees at sunset. When the sky was almost dark, they flew straight up for 30 to 60 feet, circled two or three times, and departed on a directional flight.

Songbirds usually migrate between 500 and 3,000 feet above the ground, seldom flying as high as 10,000 feet. Most maintain altitude around 1,000 feet. As a rule, larger birds and stronger flyers migrate higher, some reaching phenomenal altitudes. Airplane pilots have reported flocks of migrating lesser snow geese frequently flying between 5,000 and 6,000 feet, occasionally above 10,000 feet, and once at 20,000. Bird targets on radar, believed to be shorebirds, have been recorded at 20,000 feet and above.

Bar-headed geese routinely pass over the Himalaya Mountains between their breeding grounds in Tibet and their wintering grounds in India. Mountaineering expeditions have observed them clearing peaks above 20,000 feet. On a recent climb of 26,504-foot Annapurna I, an expedition of American women observed flocks of geese (undoubtedly bar-headed) flying over the summit on October 10, 1978.

The altitude at which birds migrate appears to be determined by a number of factors: the bird's flying "style" and strength, distances to be flown, topography, the number of migrants, wind conditions, and cloud cover.

In their final descent to land in the pre-dawn or early dawn, migrants seek out the most suitable habitat, but sometimes there is little from which to choose. In pre-dawn darkness, Swainson's thrushes have landed in the middle of Illinois fields, only to take flight for the nearest trees at daylight. Ground songbirds are frequently observed at break-of-day, making their way down from treetops. Shorebirds often fly in a zigzag pattern low over Midwestern farmland, vainly seeking shallow ponds.

Wind and rain can drive descending migrants into obstructions, breaking their wings. An even worse disaster occurred over Lake Michigan in the foggy dawns of May 30 and 31, 1976. According to Dr. William Beecher of the Chicago Academy of Science and H. David Bohlen of the Illinois State Museum, thousands of songbirds—almost forty species, including warblers and late-migrating robins—descended into the lake when fog obscured the water's surface.

Despite the great number of birds drowned in Lake Michigan that weekend, the toll was small when compared to the millions believed lost every year in migration over the Gulf of Mexico, the Caribbean, and adjacent waters of the Atlantic. Migrants facing adverse winds fly "on the deck"—so low that many are engulfed by the breaking crests of towering waves. Stories of desperate songbirds descending exhausted on ocean-crossing ships are legion. Usually these birds had been forced to fly into the wind as a spring cold front passed out to sea.

Homing

Geese, cranes, and some ducks tend to make the same stops in migration, year after year, generation after generation. The whooping crane's endangered status has given much publicity to its migration between breeding grounds in Wood Buffalo National Park, Canada, and wintering grounds at the Aransas National Wildlife Refuge near Corpus Christi, Texas. The whoopers' principal stop en route is along the Platte River near North Platte, Nebraska, an area that is being rapidly developed. In cooperation with other conservation groups and government agencies, The Nature Conservancy is currently working to protect the Platte River corridor.

Banding has demonstrated that most migrant songbirds return to the same nesting areas in subsequent years. The rare Kirtland's warbler clearly shows the importance of homing to survival. Its highly specialized breeding habitat is restricted to a few counties in north-central Michigan. The

warbler winters in the Bahama Islands. With such limited breeding and wintering grounds, and numbering only 1,000 birds or less, the species must be able to navigate well and home in on these target areas.

The most spectacular feats of homing, however, are demonstrated by marine birds. For example, the entire breeding population of greater shearwaters is confined to an island 102 miles in diameter—one of the Tristan da Cunha group in the South Atlantic Ocean. Yet, outside the breeding season, they roam the distant reaches of the North Atlantic. A close relative, the slender-billed shearwater, ranges throughout the Pacific Ocean, but returns annually to nest on islands in Bass Strait between Australia and Tasmania. Banding shows that Laysan albatrosses return in subsequent years from vast distances of the Pacific Ocean to their respective nesting sites on Midway Atoll and Laysan Island, some 1,000 miles apart. Not one albatross was found to switch nesting colonies.

Navigation

The precision of homing among such a variety of birds demonstrates that they have developed sophisticated means of navigation. No aspect of migration has been more challenging or frustrating than this phenomenon. The cues that birds use for navigation have intrigued people for centuries, but it has been within only the past two decades that we have begun to understand the cues and catalog them. A number of years ago an article on bird migration in *Life* magazine stated that since scientists had demonstrated that birds use landscape, the sun, and stars to tell where they are going, navigation was no longer a mystery. If that were only true!

Controlled experiments in the 1950's did demonstrate that birds can find directions from the sun's position. Some migrants may even be able to determine both longitude and latitude from the sun, by means of a built-in chronometer that most birds appear to possess. After these experiments it seemed reasonable to assume that nocturnal migrants orient themselves by the sun and the landscape before dark. But it wasn't true: first in Germany, Dr. E. G. F. Sauer, and then, here in the States, I discovered experimentally that birds can also obtain directional cues from star patterns.

So far, so good. The mystery seemed to be unraveling. Only a short time later, however, radar disclosed birds migrating even when clouds and darkness obscured *both* landscape *and* stars. At least some migrants can resort to other cues when the obvious ones are no longer available.

By the early 1970's, Dr. William Keeton of Cornell University and Dr. William Southern of Northern Illinois University found that birds also can orient themselves according to the earth's magnetic field. Since then, further experiments with homing pigeons suggest that they can detect polarized light, smells, and infrasound—thereby adding to their repertoire of navigation alternatives.

Migrating birds, it appears, use not one but many navigational cues, and they can change from one to another as the occasion demands. Each species has its own priority and sophistication in using these cues. Some no doubt rely on comparatively simple systems while others use more complex ones. Still unanswered, though, is how birds go from perceiving various cues to developing a "map sense"—that is, a knowledge of where they are in relation to where they want to go.

Bird migration still holds mysteries that scientists do not understand. But much progress has been made in the last two decades, and, no doubt, many of the current riddles will be solved in the years ahead. The aura of mystery surrounding migration makes the phenomenon even more intriguing, more interesting. For this reason I hope there will always be some riddles remaining for future generations to ponder.

Endangered whooping cranes congregate at their long-established wintering grounds at Arkansas National Wildlife Refuge, Texas.

A member of the Illinois Natural History Survey, **Frank C. Bellrose** recently was honored with an American Motors Conservation Award for his investigations of lead poisoning in waterfowl. He is also a Trustee of the Conservancy's Illinois Chapter and a 1978 Oak Leaf Award winner. Dr. Bellrose is the author of *Ducks, Geese, and Swans of North America* (Stackpole Books, 1978) and numerous articles.

The Snake River Birds of Prey Natural Area

by Thomas C. Dunstan

A little over a decade ago raptorial birds were considered ugly vermin—killer birds, despised for their existence. Today, 35 miles south of Boise, Idaho, within and along the Snake River Canyon, is an outstanding example of how old beliefs and stigmas have changed. This is the site of the Snake River Birds of Prey Natural Area, a 33-mile stretch of canyon that is home for an unusually large number of raptors. Thirteen species breed within the canyon.

Through the wisdom, forethought, and efforts of the Department of Interior's Bureau of Land Management (BLM) employees William Meiners and Edward Booker, and Idaho's eagle man and film-maker, Morlan Nelson, the Birds of Prey Natural Area was created in 1971. At that time, the raptors' nesting sites—some 26,300 acres of riverside land—were given temporary legal protection by then-Secretary of the Interior, Rogers C. B. Morton. But it was only the beginning. . . . As Dean Bibles, BLM Boise District Manager, succinctly put it, "We have saved the birds' bedroom, but not their kitchen."

Later, after Secretary of the Interior Cecil Andrus declared temporary protection for a yet larger area, The Nature Conservancy recognized that there were critical private inholdings of land used by the raptors within the Birds of Prey Natural Area. In 1978 it initiated a $500,000 campaign to purchase five of the most important inholdings—areas amounting to 900 acres. Besides birds of prey, the properties contain valuable marshlands and Snake River frontage, Indian caves, an old stone homestead, box canyons, and springs. The Conservancy's commitment also included raising funds for proper management of the areas and for future education and research.

The Birds of Prey Fund-Raising Committee consisted of an impressive list of national and international conservationists, naturalists, educators, and elected officials. By the end of 1978, the Conservancy had acquired the 900 acres of critical habitat in the heart of the Birds of Prey Natural Area.

Meanwhile, in 1973, the Bureau of Land Management initiated one of the largest studies ever undertaken of raptorial birds and their needs. My role in the research was to document the hunting behavior and ranges of three indicator species—the golden eagle, red-tailed hawk, and prairie falcon. Other scientists studied the behavior and ecology of badgers, coyotes, ground squirrels, song birds, reptiles, rabbits, and plants, as well as the energy relationship among all the various organisms in the Birds of Prey Natural Area.

Your first view of the Snake River Canyon and the surrounding landscape may be rather unimpressive. I have heard comments range from "What a dull place," to "Where are the birds?" At first glance, the neatly plowed fields and acres of sugar beets and potatoes are the most impressive features of the area, except for the somewhat awe-

some appearance of the 100- to 800-foot gray, basalt canyon outlining the river. However, looking closer, you see the subtle and sometimes startling things of beauty that make the Birds of Prey Area special during all seasons.

Red, orange, and blue-green lichens, and yellowish-green mosses cover the north-facing surfaces of many small and large rocks. These plants also grow on the stems of big sagebrush, adding to the bushes' natural, twisted beauty. Spring and summer bring out the flowers—penstemon, desert paintbrush, and yellow blossoms on green cacti. Small white, pink, and violet flowers dot the landscape.

From mid-April to mid-June the big show in the canyon is the breeding and nesting activity of the 200 pairs of prairie falcons, 60 pairs of red-tailed hawks, and 30 pairs of golden eagles. The eagles lug jack rabbits to their young. The canyon speedsters, prairie falcons, "cak" noisily and defend their nest sites against all visitors. Red-tailed hawks flap and glide carrying 4-foot long gopher snakes to add to the squirrel-lizard-and-snake smorgasbords for their ever-ravenous offspring.

During the day, you may catch glimpses of the night birds—great horned, screech, long-eared, and barn owls—which, when disturbed, hasten quietly in and out of the canyon's many crevices. Away from the canyon walls, the little burrowing owls enjoy flitting around old badger holes. Coyotes and deer haunt the riverside vegetation and drift between the boulders, big sagebrush, and shadscale. Townsend ground squirrels seem to be everywhere, scurrying over the "flats" north of the Snake River Canyon. These little bundles of energy are the "groceries" for many of the area's raptors. In fact, prairie falcons flew up to 14 miles away from the canyon to hunt the squirrels for themselves or their young.

After June, temperatures of over 100 degrees

Clockwise from top left: barn owl; ferruginous hawks; author Dunstan in eagle nest; fledgling long-eared owls; fledgling golden eagle; sunlit cliff.

cause green vegetation to dry up. Herbivorous animals, dependent on the succulent grasses, must estivate (go into a torpor) until the next spring—around February—or literally move on to greener pastures. The predators dependent on Townsend ground squirrels modify their food habits or leave the area—the most impressive example is the exodus of hundreds of prairie falcons (the BLM estimates that it is 10 percent of the world's population). The eagles and red-tailed hawks switch and eat jack rabbits and cottontails. In the fall, the redtails and young eagles drift off. As the rough-legged hawks and a few bald eagles arrive for the winter, the avian giants of the Birds of Prey Area—the golden eagles—remain in their territories, waiting for another breeding season.

The unique biological and archaeological features of the land have been recognized. Based on the completed research, the present goal of BLM is to establish a Snake River Birds of Prey National Conservation Area, which will encompass 720,000 acres including the Snake River Birds of Prey Natural Area. Now the decision about the boundaries of the larger sanctuary must be made, and it is the public and Congress who will be the judges.

Thomas C. Dunstan is an associate professor of biology at Western Illinois University. Besides teaching, researching, and leading field trips, he is a writer and photographer—his work has appeared in both *National Geographic* and *Audubon*. Dr. Dunstan is also the land steward for the Conservancy's Cedar Glen Eagle Roost.

Cedar Glen

Land of Wintering Eagles

by Thomas C. Dunstan

South of Chicago is the prairie state of Illinois. The Mississippi River passes down the entire western border of the state. During the fierce cold days in the dead of winter each year, our national bird, the bald eagle, gathers along the "Mighty Miss" in large numbers. At the Cedar Glen area, near the river's Lock and Dam 19 in west-central Illinois, eagles find a rare wintering situation that is vital to their survival during the 5- to 6-month period when they are away from their breeding ranges in the northern states and Canadian provinces.

Since 1969, as an associate professor of biology at Western Illinois University, I have been conducting research on wintering eagles at Cedar Glen and at other sites up and down the Mississippi River. As a young boy, and later as a professional biologist studying the breeding ecology of eagles in Minnesota, I puzzled over the question of where breeding eagles go and what they do during the winter. After nine years of study, and through the combined efforts of my students and colleagues at the University and the Illinois Chapter of The Nature Conservancy, the answer is partially known. We have also helped raise people's consciousness about our responsibility for protecting this endangered raptor. In 1970, Cedar Glen and the surrounding 182 acres were purchased by the Conservancy in order to save an eagle night roosting site from potential destruction,

and to safeguard eagles from human encroachment and harassment.

Cedar Glen is an eroded "punch bowl" about 4 acres in size, located among and behind an upland ridge of Keokuk limestone of Valmyerian age. The "bowl" lies adjacent to the Mississippi River. Most of its rim is surrounded by a natural windbreak of red, black, and chinquapin (*Querces muhlenbergii*) oaks, the latter species typically associated with dry limestone buffs. In the bottom of the glen and bowl area are several large sycamores with widely spread branches that are the eagles' favored perch sites. On clear, frigid winter nights when the moonlight glistens off the snow, 20 to

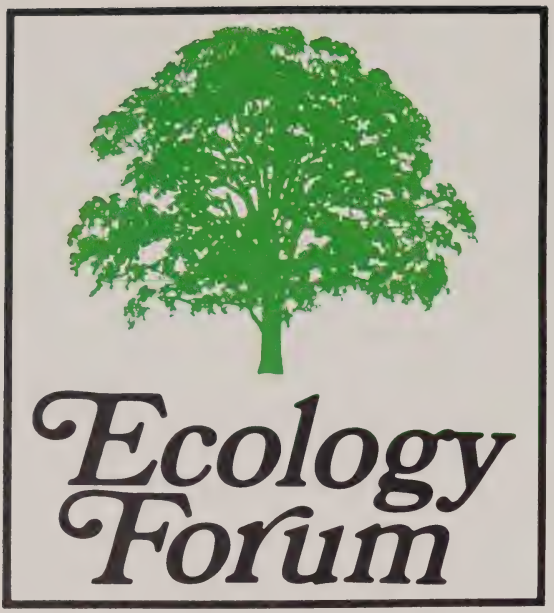
40 eagles can be seen perched side-by-side in each of the trees.

Annually, the Illinois Chapter of The Nature Conservancy organizes a winter field trip to Cedar Glen to see the eagles and to share new information with interested members. For example, we have discussed and explained the three habitat-use areas that are important to eagles. One area is comprised of the primary feeding and eating sites between Warsaw, Illinois, and Lock and Dam 19 on the Mississippi. The second habitat consists of loafing areas—sites away from the river, which are protected from wind and exposed to the warming rays of the sun. The area adjacent to Eagle Island and the newly discovered Crystal Glen area next to Cedar Glen comprise the kind of habitat that the eagles use and need as roosting sites. We have also discussed the eagle's food habits and fishing behavior.

Since the initial purchase of the Cedar Glen night roost in 1970, the Conservancy has also purchased Mud Island, Eagle (Mink) Island, and mainland areas used for feeding, eating, loafing, and some night roosting. The Conservancy's project now encompasses about 580 acres. Several critical areas, including the newly-documented Crystal Glen Night Roost, are worth protecting in the immediate future. Acquiring these additional areas would safeguard an entire system of components necessary to the survival of bald eagles in winter. The Conservancy also joined the Illinois Superintendent of Public Instruction's Office and the Illinois Audubon Society in a school children's "Dimes for Eagles" drive in 1976. Funds from the drive were used to purchase the Prairie State Eagle Refuge—also known as the Children's Eagle Refuge—adjacent to the Conservancy's properties.

Last winter, during the blizzards of '78-'79, Cedar Glen appeared to be the "true Mecca" for bald eagles in the Midwest. Data from the National Wildlife Federation's First National Census of wintering bald eagles in the 48 contiguous states documented the presence of 1,295 eagles along the Mississippi River from Minneapolis, Minnesota, to Cairo, Illinois. The majority ate, loafed, and roosted along the Illinois shore of the Mississippi. This large number of eagles exceeded counts made in any other state censused. The "Land of Lincoln" became the "Land of Wintering Eagles." The significance of the Cedar Glen area itself was never more apparent—the white heads and tails of hundreds of adult bald eagles could be seen brightening the clear, blue January skies. We recorded a record high minimum number of 454 eagles (359 adults, 88 immatures, and 7 eagles of undetermined age) in Cedar Glen during the national count. This total is about *double* the usual number that frequents the area. Also, it was seven or more times greater than numbers from any other single site censused along the Mississippi River.

The Glen's future is promising, but not secure. All necessary habitat requirements must be met—guaranteeing only part of the ecosystem is not enough to protect the eagles. Present activities, such as the building of the new interstate bridge from Iowa to Illinois right through the study area, require that we continue our efforts to acquire additional and necessary critical habitat. This time we can provide information for making decisions about bridge locations and construction activities; however, time is short. Past debts have to be paid so new areas can be purchased. Furthermore, what we learn at Cedar Glen can also be used to preserve other habitats for wintering eagles, both along the Mississippi River and throughout North America.



No. 33
by Robert Chipley
Director, National Research Operations

THE RED-COCKADED WOODPECKER

Before European settlement, the red-cockaded woodpecker (*Picoides borealis*) was the most common woodpecker in the pine woods of the South. Along with the pine warbler and the brown-headed nuthatch, this small woodpecker inhabited the open park-like stands of pines where periodic fires destroyed the woody undergrowth, preventing succession of the forest to hardwoods. The pine warbler and the brown-headed nuthatch, though not perhaps as common as they once were, can still be found without too much difficulty. The red-cockaded woodpecker, however, has become quite rare, so much so that it is now listed by the federal government as endangered throughout its range.

The reason for its decline is well known. Unlike the nuthatch and the warbler, the red-cockaded woodpecker has one requirement that puts it at odds with the modern world and may eventually bring about its extinction: it needs pines infected with a fungus, red heart disease (*Fomes pini*), in which to excavate its nesting and denning cavities. The disease, which rots out the heartwood while leaving a living exterior, affects only mature pines —the average age of a cavity tree is about 70 years. Unfortunately for the woodpecker, it is a modern forestry practice to harvest pines on a 25- to 40-year rotation—well before the age when they contract the disease and become suitable as cavity trees. As a result, old-growth pine forests of the South, once so common, have become quite rare and scattered. As these forests have disappeared, so has the woodpecker.

The red-cockaded woodpecker has been the subject of many studies, and a great deal is known of its life history. Gregarious for a woodpecker, it lives in family units (misleadingly termed "colonies") consisting of a single breeding pair and the offspring of previous broods, which assist their parents in raising further broods. The home range of the family unit or clan varies with the quality of the habitat; average size approaches 200 acres and in poor habitats may be as large as 1,000 acres. Within this home range, the clan excavates several cavities, generally in the same vicinity. The birds may work for several months or even years on a single cavity. The cavity hole itself is quite distinctive. Resin exudes from its margins and from smaller holes (termed "resin wells") drilled by the birds both above and below it. The birds maintain this flow of sap as long as the cavity remains active. There are several adaptive advantages of this arrangement. First, it has been demonstrated that the sap discourages black rat snakes from entering the cavity, and may discourage other predators as well. Second, cavity trees are quite conspicuous because of the copious sap streaking the trunk. This marking may serve a territorial function. Third, in a habitat subject to frequent natural fires, a living tree offers a far greater degree of protection to a nest than a dead tree.

However many advantages the woodpecker's habit conferred in the past, these have all been erased by the disappearance of diseased pines. Furthermore, at this stage, it is unlikely that the bird will survive without a concerted effort to preserve it. Dr. Jerome Jackson of Mississippi State University, a leading researcher on the red-cockaded woodpecker (much of the information in this article is taken from his work), feels that the species is continuing to decline. Recently, through questionnaires sent to public land-managing agencies and private conservation groups, Dr. Jackson, who heads the U.S. Fish and Wildlife Service Recovery Team for the woodpecker, learned the location of 3,454 colonies. Since the bird has received much attention from both professional and amateur ornithologists, this figure probably represents most of the surviving colonies. Were all these colonies still active, the total number of individuals would approach 12,000. In a spot check of 172 of these colonies, however, Dr. Jackson found that over half were abandoned. Thus, a more accurate total is in the range of 5- to 6,000 individuals. It is particularly disturbing that there are *no* records of

new colonies being established within the past ten years.

The decline of the red-cockaded woodpecker can be arrested only through management of selected areas to sustain the species. Since 70 percent of existing colonies are on public lands, it is here that the major effort must be made. Management simply consists of setting aside land units of adequate size to support a colony and then assuring that the original conditions of the southern pine forests are restored or approximated within these units. This means adopting longer rotation periods and allowing the pines to reach the age at which they contract red heart disease. Also, young pines should be thinned, and periodic controlled burning should be used to destroy invading hardwoods, thus maintaining the open, park-like forest the birds prefer. Practices within the vicinity of these units also must be modified. One threat to the bird is creating new or increasing the size of old impoundments (bodies of water created by dams) near its colonies. This invariably makes the habitat more attractive to the pileated woodpecker, which prefers moist woodland; it moves in and enlarges the red-cockaded cavity holes, finally destroying the colony.

It is not suggested that all the pine forests of the South be managed to sustain the red-cockaded woodpecker; rather, certain optimal or potentially optimal areas should be chosen. Since mere human presence does not disturb the birds, there are many compatible multiple uses for such lands. Colonies of red-cockaded woodpeckers have been observed in picnic areas, developed campsites, work centers, moderately developed housing subdivisions, hunting preserves, along nature trails, and significantly, even in the medians and along the rights-of-way of interstate highways. The latter fact has led Dr. Jackson to suggest that, if they are judiciously planned and maintained, the rights-of-way of interstate highways could serve not only as viable habitat for the birds, but also as links between colonies that would otherwise be isolated. In addition, they could serve as routes for dispersal to new suitable areas. It would be a rare but welcome event if a public works project could actually facilitate the survival of an endangered species, instead of further imperiling it.

PHOTOS: Susan Bournique, pp. 14-15; Cameron Davidson, p. 22 bottom; Wallace C. Dayton, p. 30; Scott R. Derrickson, p. 7; Adrian Dignan, p. 16; Thomas C. Dunstan, pp. 20 left, 21, 22 top, 26; Amos Eno, p. 19; Luther Goldman/Fish & Wildlife Service, p. 18; Heather R. Iler, p. 17; Michael H. Madany, p. 28; Roger Tory Peterson, p. 4-5; R. J. Shallenberger, pp. 9, 11 right, 12, 13; U.S. Forest Service, p. 8; Rick Warner, p. 11 left; Gus Wolfe, p. 20 right; David Zimmerman, p. 6.

The Nature Conservancy has preserved or assisted other conservation groups or agencies in preserving habitats for the following nationally endangered or threatened bird species:

bald eagle
peregrine falcon
masked bobwhite
golden eagle
California clapper rail
brown pelican
California least tern
California condor
boat-billed heron
scarlet macaw
harpy eagle
red-necked parrot
cape-sable sparrow
red-cockaded woodpecker
Florida everglades kite
sisserou parrot
dusky seaside sparrow
Kirtland's warbler
Maui parrotbill
crested honeycreeper
Maui nukupuu
akiapolaau
Hawaiian creeper
omao
ou
amakihi
apapane
akepa
io
palila
iiwi
Mississippi sandhill crane
Bachman's warbler
Attwater prairie chicken

NEW PROJECTS

Connecticut

BLUFF HEAD PRESERVE. Four genera of fish fossils, one of which is found in only two other places in the world, are found in a 180-million-year-old shale deposit on this 75-acre tract. Two streams traverse the property, which is forested with hemlock, birch, beech, and oak. Management of the area will be the responsibility of the Connecticute Chapter, which is raising funds for the project.

Florida

CROCODILE PRESERVE (Monroe County). This 18-acre area of mangroves, mahogany, Jamaica dogwood, and burned over West Indian hammock provides critical buffer for four active American crocodile nests. The crocodile, a federally endangered species, is protected by the U.S. Fish and Wildlife Service, to whom the property will be transferred.

Illinois

NELSON LAKE MARSH (Kane County). While most marshes with this type of plant community have been destroyed by drainage, grazing, or dredging, this 175-acre area remains as one of the largest and finest alkaline marshes in the state. Fringed gentian flowers bloom in abundance in the early fall, and hoary willow and dwarf birch, found only in fens and bogs, rise up out of the joint grass and rushes. Osprey, American bittern, black crowned night heron, and yellow-bellied sapsucker have been spotted on the property. The marsh will be dedicated and managed as a State Nature Preserve. Fund raising and management is the responsibility of the Fox River Conservation Union of the Conservancy, until the transfer of the property to the Kane County Forest Preserve District. The Union, made possible by a grant from the Bersted Foundation, seeks to identify and protect natural areas in the Fox River Watershed, which includes parts of Kane, McHenry, DuPage, and DeKalb Counties.

Kentucky

KENTUCKY RIVER PALISADES PRESERVE (Woodford County). Exposed segments of the cliffs of this 24-acre gift of Mrs. W. R. Kirwin provide evidence of movement of the earth's crust and contain marine fossils from an ancient sea that once covered this portion of Kentucky. The area will be leased to Eastern Kentucky University to be managed as a nature preserve.

Minnesota

MINNESOTA PRAIRIE CHICKEN PRESERVE SYSTEM — Addition — (Wilkin County). The

Anna Gronseth Prairie Addition—80 acres of low and wet, slightly alkaline, tallgrass prairie—supports the greater prairie chicken, which is protected on the now 840-acre preserve. The property lies at the base of the highest beach ridge of glacial Lake Agassiz. Springs, seeps, and poor drainage have made the area less suitable for farming, so that it remained undeveloped in this heavily cultivated area. The property will be managed by the Minnesota Chapter.

Mississippi

PASCAGOULA — Addition — (Jackson and George Counties). Including frontage on Red Creek and Black Creek, as well as inholdings along the meandering Pascagoula River, these 3,000 acres were optioned by the Conservancy for less than fair-market-value from the International Paper Company. The State of Mississippi then purchased the property as an addition to the Pascagoula Wildlife Management Area encompassing 35,000 acres of unique bottomland hardwood forest and wetlands. Bottomland hardwood forests are rapidly disappearing in the south. The river basin is the only known home of the yellow-blotched sawback turtle and also provides habitat for the rare swallow-tailed kite, and two rare snakes—the rainbow and glossy water snakes. The area is managed by the Mississippi Wildlife Heritage Committee.

Missouri

MISSOURI PRAIRIE — Addition — (Barton County). Portions of this gently rolling 60-acre tract are considered to be the finest prairie in the state. Vigorous stands of native grasses, including big and little bluestem, broomsedge, threeawn, purple prairie clover, and foxtail grass, are found all over the area. Home for prairie chickens and upland sandpipers, the property also includes over a mile of prairie stream. The land has been transferred to and is managed by the Missouri Department of Natural Resources.

Montana

TOUSSAINT RANCH (Deer Lodge County). A conservation easement donated by Conservancy Board of Governors member and former executive vice president, Dr. G. Jon Roush, will protect these 520 acres in the foothills of Mt. Evans and Mt. Howe in the Sullivan Creek drainage. More than half of the property is forested with lodgepole pine and quaking aspen, while the rest is comprised of grasslands and willow wetlands. Documented sightings attest to the presence of the rare northern Rocky Mountain wolf on the ranch, along with sandhill cranes, elk, moose, mule deer, black bears, badgers, coyotes, minks, otters, and Canada lynx. The property will be managed within the context of the property's historical uses by the owner.

Nevada

BIG SPRING DESERT PUPFISH SANCTUARY —Addition—(Nye County). Located just east of the Death Valley National Monument, the 317-acre property not only contains a warm-water stream with a healthy population of an endangered desert pupfish, but also supports endemic and endangered plants. The pupfish thriving in Big Spring (*Cyprinodon nevadensis* var. *mionectes*) is one of five remaining pupfish species and six subspecies, each endemic to the body of water in which it evolved. The area, an inholding in the Bureau of Land Management's Ash Meadows Natural Area, will be transferred to and managed by the Bureau.

New York

WERTHEIM NATIONAL WILDLIFE REFUGE —Addition—(Suffolk County). Two additions totaling 128 acres will be added to the Wertheim National Wildlife Refuge, part of an area with the highest concentration of waterfowl on Long Island. A bald eagle, great blue herons, osprey, rough-legged hawks, marsh hawks, short-eared owls, long-billed marsh wrens, and 20 varieties of warblers have been spotted in the area. The Carmans River, which along with its tributaries flows through the refuge, is classified as scenic under the New York State Wild, Scenic, and Recreational Rivers Act. The area will be transferred to and managed by the U.S. Fish and Wildlife Service.

North Carolina

WEYMOUTH WOODS (Moore County). Three colonies of endangered red-cockaded woodpeckers nest on the 191-acre property, 68 acres of which support the last known major stand of old-growth long-leaf pine in North Carolina. The 40-room Boyd house and its 24-acre grounds have been conveyed to the Friends of Weymouth, an historic preservation group, and the remaining forests and meadows have been transferred to the State of North Carolina Department of Natural Resources and Community Development for addition to Weymouth Woods Nature Preserve.

Ohio

WALTON WOODS (Wayne County). A reverter interest in 10 acres of remnant old growth oak-hickory forest was donated to the Conservancy by the State of Ohio. The Conservancy, along with

Braidwood Dunes and Savannah

On a cold day last December, representatives of the Illinois Chapter outbid several land developers at an outdoor auction to buy 205 acres of land from the Peabody Coal Company. For the sum of $275,000, the Conservancy gained title to what the Illinois Nature Preserves Commission has rated the largest and best preserved of the few remaining natural areas in the 80-mile-long Kankakee Valley.

Located 55 miles southwest of Chicago, the property is made up of four distinctly different plant communities supporting more than 300 species of native flowering plants. The rarest plant community, the black oak savannah, dominates the crests and slopes of the dunes. Scattered virgin stands of black oak are juxtaposed with an unusual understory of little bluestem and porcupine grasses.

Further down the slopes, sand prairies closely resembling the coastal plains of the south Atlantic states support several incongruous plant species. Prickly pear cactus, Indian and big bluestem grasses, a large stand of fall-blooming ladies tresses orchids, and tuberculed orchids, *Platanthera flava* (proposed for federally endangered status), are all nourished by the prairie's sandy, acidic soils.

In the spring, the swales between the dunes flood, maintaining sedge meadows and cattail marshes where migrating waterfowl rest. But the marsh also support some plants more common to bogs such as sphagnum moss and purple St. Johnswort.

Redheaded woodpeckers can be found in the savannah, and the great horned owl hunts the open areas at night, perhaps for an elusive lizard, the six-lined racerunner.

Braidwood Dunes and Savannah was on the Conservancy's national list of the top 20 target projects proposed for completion in 1978, and was the number one priority for the Illinois Chapter. The Chapter has mounted a drive to raise $275,000 toward repaying a loan from the national Project Revolving Fund. The preserve will be transferred to the Will County Forest Preserve District and managed by Olivet Nazarene College.

the property's other owner, the Killbuck Chapter of the Izaak Walton League, will donate the property to the City of Wooster for administration as a natural area by its Parks and Recreation Division.

Oregon

FREMONT NATIONAL FOREST (Lake County). Dog Lake, a 400-acre expanse of water surrounded by a freshwater marsh, lies within this 2,100-acre addition to the Fremont National Forest. Osprey, snowy egrets, and western grebes frequent the land's herb-grass meadows and forests of juniper, aspen, ponderosa pine, and low sagebrush. The property will be conveyed to and managed by the U.S. Forest Service.

TABLE ROCK—Kelly Slough Addition—(Jackson County). Curling around the southwestern foot of Lower Table Rock, 177-acre Kelly Slough is the best example of cottonwood/willow riparian habitat in southwestern Oregon. The Rogue River meanders through a bayou-like maze of channels and sloughs among cattail marshes, willows, and forests of cottonwood and ash. Northern bald

eagles and American osprey feed here, and great blue herons return annually to a rookery of over 30 nests. Kelly Slough has been transferred to the Jackson County Parks Department, which is responsible for management of the area as part of the Bear Creek Greenway project.

TOE ISLAND (Multnomah County). An undisturbed one-acre island in the Willamette River is a gift of the Ross Island Sand and Gravel Company. The property will be given to the City of Portland.

Wisconsin

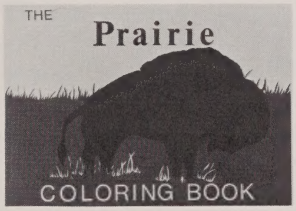
RENAK-POLAK WOODS—Addition—(Racine County). Consisting of both woods and cropland, the 13-acre tract will provide important buffer for the Renak-Polak Woods, one of two remaining maple-beech climax forests in southeastern Wisconsin. A population of a federally threatened species is located in the woods. The property is frequently used for teaching and research by the University of Wisconsin-Parkside. Management of the area will be the responsibility of the Wisconsin Chapter until transfer to the University of Wisconsin is complete.

RUSH CREEK BLUFFS (Crawford County). Over two miles of rugged Mississippi River bluffland form the western boundary of 994 acres of high quality forest, prairie, trout stream, bottomlands, and sandstone cliffs. Dry hillside prairies remain undamaged on the southwest faces of the bluffs. Red-shoulder hawks, threatened in Wisconsin, nest and hunt in the bottomlands. Offering outstanding scenic views, the bluff tops were threatened by development. The preserve, the highest priority acquisition identified by the Scientific Area Preservation Council of Wisconsin's Department of Natural Resources, may be transferred to the state agency for management.

CORRECTIONS

The Henry Van Deusen, Jr., addition to Lacawac Sanctuary, Pennsylvania, was incorrectly listed as the Harry Van Deusen, Jr., tract in the July/August issue.

In the May/June Annual Report issue, the full name of the Benua Preserve, Ohio, should have read, "William E. and Emily P. Benua Nature Preserve." The preserve was a gift of both William and Emily Benua.



CONSERVANCY COLORING BOOKS AVAILABLE

The Nature Conservancy's new Virginia Coast Reserve and Prairie Coloring Books are now available from the National Office. The two 32-page coloring books were designed to promote greater appreciation and understanding of prairie and coastal ecosystems.

The Virginia Coast Reserve Coloring Book highlights the colorful history of the barrier islands, their unique plant and animal life, and The Nature Conservancy's role in their preservation. Captain John Smith, Blackbeard the Pirate, and the Machipongo Indians are among the interesting characters included in this book.

The Prairie Coloring Book gives a glimpse of the diverse plant and animal life and the interrelationships that contribute to the unique prairie ecosystem. The book acquaints the young colorer with the prairie's history—from buffalo and Indian to railroad and farm—and with the many life forms the prairie harbors, including yellow-headed blackbird, ferruginous hawk, and pronghorned antelope.

As a special introductory offer, the coloring books are priced at $1.50 each for Conservancy members ($1.75 each for non-members). They may be obtained by sending a check, payable to The Nature Conservancy, to: Secretary, Land Stewardship, The Nature Conservancy, 1800 N. Kent Street, Arlington, Virginia 22209. Please be sure to specify the title and quantity of coloring books desired.

Katharine Ordway

by Patrick F. Noonan, President, The Nature Conservancy

On a hot June day in 1975, Katharine Ordway gazed out from beneath her parasol across hundreds of the 7,600 acres that make up the Samuel H. Ordway Memorial Prairie in South Dakota. Her contribution of almost $1.5 million had provided the funds to purchase the vast grassland, which was named to honor her cousin, a pioneer American conservationist. That visit was the first time Miss Ordway had had a chance to walk through the South Dakota prairie preserve—to see the more than 400 wetlands, or "potholes," that are the nurseries and homes for thousands of waterfowl. It was also one of her few opportunities, as an adult, to return to the midwestern grasslands of her childhood.

Earlier in the day, under a cloudless bright blue sky, Miss Ordway had asked many questions of the small party of Conservancy staff, Board of Governor members, and friends accompanying her. She was interested in learning about future management plans for the Ordway Prairie. A dedicated amateur naturalist, she sought information on the technical aspects of grassland botany from a prairie researcher on hand for her visit. She also asked about the prairie's wildlife, its birds, and wildflowers.

More than any other single individual, Katharine Ordway was the "lady who saved the prairies." When she passed away last spring at the age of 80, Miss Ordway's concern and philanthropy had resulted in a system of grassland preserves in five states,

which all together amounts to approximately 31,000 acres. From the prairie potholes of the north, to the tall grasses of Kansas, to the rolling swales of Missouri, the Conservancy's Ordway Prairie Reserve System had grown to be the most extensive grassland sanctuary system in the nation.

Katharine Ordway preferred anonymity to headlines. So most of the hundreds of families and dozens of researchers who have visited the prairies each year know nothing of the quiet, generous woman who created the preserves. Neighbors near her Connecticut home did know of her interest in conservation, however. Named for her father, the Conservancy's Lucius Pond Ordway/Devil's Den Preserve—now a 1,500-acre wooded wildlife refuge in Fairfield County, Connecticut—was established in 1966 by Miss Ordway. The Devil's Den Preserve is one of the largest forested expanses still remaining in southwestern Connecticut.

In recognition of her personal commitment to conservation, the Conservancy's Board of Governors paid special tribute to Miss Ordway in 1978 by appointing her the Conservancy's first Land Guardian.

More recently, Miss Ordway responded to yet another Conservancy conservation need by providing a major gift to the Virginia Coast Reserve—to continue protection of the 13 barrier islands.

In her will Miss Ordway made provision for a special place near her home in Connecticut to become a Conservancy sanctuary. To be known as the Katharine Ordway Preserve, the new refuge is not far from Devil's Den. It is crossed with quiet trails that cut beneath tall trees. The tranquility of the sanctuary will allow visitors to appreciate the natural world and, in doing so, to gain a better understanding of themselves. The preserve has been dedicated to Miss Ordway in recognition of her contribution to the cause of natural area preservation.

Philanthropy can take many forms, but few are as lasting as the fashion in which Katharine Ordway exercised her concerns. From the colorful wildflowers of a midwestern prairie, to a sparkling stream in an eastern forest, to the very edge of the Atlantic Ocean, Miss Ordway left a legacy that will last far beyond our generation.

Thank you, Katharine Ordway.

NEW LIFE MEMBERS

An individual becomes a Life Member of The Nature Conservancy upon contribution of $1,000 for membership dues.

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A corporation becomes a Corporate Associate of The Nature Conservancy upon contributing between $1,000 and $10,000 annually to the operations of the organization.

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THE NATURE CONSERVANCY

Eastern Regional Office
294 Washington Street, Room 850
Boston, Massachusetts 02108
(617) 542-1908
Bradford C. Northrup, Vice President

Midwest Regional Office
328 East Hennepin Avenue
Minneapolis, Minnesota 55414
(612) 379-2134
John W. Humke, Vice President

Western Regional Office
425 Bush Street, 5th floor
San Francisco, California 94108
(415) 989-3056
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New York Development Office
36 West 44th Street, Room 307
New York, New York 10036
(212) 869-9532
William B. Carlin, Director

Mid-Atlantic Field Office
Chevy Chase Center Office Bldg.
35 Wisconsin Circle, Suite 304
Chevy Chase, Maryland 20015
(301) 656-8673
Steve Hamblin, Representative

Northwest Field Office
1234 N.W. 25th
Portland, Oregon 97210
(503) 228-9561
Spencer Beebe, Representative

California Field Office
425 Bush Street, 5th floor
San Francisco, California 94108
(415) 989-3056
Peter Seligmann, Representative

Colorado Field Office
820 Sixteenth Street, Suite 420
Denver, Colorado 80202
(303) 623-8088
Chip Collins, Representative

Florida Field Office
10395 S.W. 132 St.
Miami, Florida 33176
(305) 238-0148
Dick Ludington, Representative

Indiana Field Office
Route 1, Box 155
Nashville, Indiana 47448
(812) 988-7547
Marion Jackson, Representative

Michigan Field Office
Suite F, 531 N. Clippert Street
Lansing, Michigan 48912
(517) 332-1741
Michael L. Green, Representative

Minnesota Field Office
328 East Hennepin Avenue
Minneapolis, Minnesota 55414
(612) 379-2134
Geoffrey S. Barnard, Representative

New Mexico Field Office
610 Gold Ave., S.W.
P.O. Box 1846
Albuquerque, New Mexico 87103
(505) 242-2015
William C. Briggs, Representative

North Carolina Field Office
P.O. Box 805
Chapel Hill, North Carolina 27514
(919) 967-1406
Thomas Massengale, Representative

Ohio Field Office
1504 West 1st Avenue
Columbus, Ohio 43212
(614) 486-4194
David Younkman, Representative

Oregon Field Office
1234 N.W. 25th
Portland, Oregon 97210
(503) 228-9561
Al Edelman, Representative

South Carolina Field Office
P.O. Box 5475
Columbia, South Carolina 29250
(803) 254-9049
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Tennessee Field Office
1720 West End Avenue, Suite 600
Nashville, Tennessee 37203
(615) 320-1465
Catherine Day Lohman, Representative

Texas Field Office
201 N. St. Mary's
Suite 618
San Antonio, Texas 78205
(512) 222-9665
R. Scott Spann, Representative

Vermont Field Office
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Virginia Field Office
415 Park Street
Charlottesville, Virginia 22901
(804) 295-6106
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Washington Field Office
618 Smith Tower
Seattle, Washington 98104
(206) 624-9623
Elliot Marks, Representative

West Virginia Field Office
1100 Quarrier Street, Room 215
Charleston, West Virginia 25301
(304) 345-4350
Ed Maguire, Representative

Wisconsin Field Office
1922 University Ave.
Madison, Wisconsin 53705
(608) 233-9721
Russell Van Herik, Representative

Connecticut Chapter
Science Tower, Box MMM
Wesleyan Station
Middletown, Connecticut 06457
(203) 344-0716
Evan Griswold, Director

Illinois Chapter
666 N. Lake Shore Drive
Suite 1919
Chicago, Illinois 60611
(312) 787-1791
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Maine Chapter
335 Water Street
Augusta, Maine 04330
(207) 623-2951
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Long Island Chapter
P.O. Box 72
Cold Spring Harbor, New York 1172
(516) 367-3225
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Lower Hudson Chapter
RFD #2, Chestnut Ridge Road
Mt. Kisco, New York 10549
(914) 666-5365
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P.O. Box 188
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